

DOUBLE-BROODEDNESS IN PURPLE MARTINS IN TEXAS

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Most ornithologists consider Purple Martins (*Progne subis*) to be single-brooded throughout their range, although this is a somewhat controversial topic. Allen and Nice (1952), Lee (1968), Layton (1969), and Lowery (1975) stated that martins are single-brooded with little or no evidence of double-broodedness. Yet Forbush (1929), Baerg (1931), and Sprunt (*in Bent* 1942) believed the birds to be double-brooded; Audubon (1840) mentioned third broods in Louisiana. Peterson (1941) and Harrison (1975) indicated that martins occasionally raise second broods in the southern United States. Johnston and Hardy (1962) recognized martins as usually single-brooded but reported second broods in southern Illinois.

Allen and Nice (1952) questioned *all* second broods, providing testimonials from southern martin fanciers to the effect that there is insufficient time during the martin's breeding season for double broods. Skepticism might arise from a lack of details regarding reports of double-broodedness. Despite the several references to second broods, the only detailed report in the literature is my (1973) account of a second brood in 1970 in north central Texas.

In 1976-1977 I observed 6 additional second broods by Purple Martins in north central Texas. This paper will explain these occurrences, analyze environmental conditions and stimuli, and offer an hypothesis regarding double-broodedness in Purple Martins.

DESCRIPTION OF THE MARTIN COLONY

The martin colony was located in my residential backyard within the city of Sherman, Grayson County, north central Texas. In 1976-1977 the colony contained 110 and 72 apartments respectively and consisted of 7 and 4 martin houses of various sizes and designs. Fourteen other active martin colonies were located within a 1.6 km radius from my colony. Prior to 1976 martins had nested at this location for 8 years.

In 1976, 35 pairs of martins attempted to nest in my colony. Of those, 18 (51.4%) appeared to be adult pairs and 17 (48.6%) appeared to be subadult (i.e., 1st year) pairs. Sixteen (45.7%) pairs raised 1 brood and fledged young on the first attempt. Six (17.1%) pairs raised 1 brood and fledged young on the second attempt, having failed for various reasons on the first attempt. Nine (25.7%) pairs failed to fledge young on either attempt. Four (11.4%) pairs fledged second broods. In 1977, 27 pairs of martins nested in the colony, but I did not collect detailed breeding data for that year.

The 1976 figures were compiled after intensive surveillance of the martin colony throughout the breeding season. I closely watched the colony for several hours each day from the arrival of the first martins in February until the last brood departed in August. I made nest checks daily. An assistant and I banded 638 martins in the Sherman area in 1974-75. Several of these banded martins were present at my colony in 1976.

OBSERVATIONS

I spent 1000 ($\pm 5\%$) h watching the martin colony during the breeding season of 1976. My intense surveillance of the colony was significant since 3 of the 4 pairs involved in second broods were unmarked. I spent many hours watching these birds and am fully convinced of the validity of the results. Individual recognition of unmarked birds is discussed further below.

Pair 1: An all-purple adult male and an adult female arrived at the colony on 20 February 1976. In contrast to many martins that claim several rooms in the early part of the season, this pair claimed only 1 room throughout the breeding season. Four young of their first brood left the nest on 29 May. After the young fledged, the adults led them back to the nest compartment to roost nightly until 5 June.

On 5 June I began noticing Pair 1 perching by their nest and entering the nest compartment. I assumed that the young had become independent and that the adults were displaying post-breeding nest defense. Post-breeding nest defense is common among martins. No juveniles returned to the nest on 5 June nor at any time afterward. Pair 1 remained at the colony for long periods on 5-15 June but never brought nesting materials to the nest during that time. On 16 June one egg was laid in the old nest, followed by another on 17 June. The female began incubation on 17 June after laying the second egg. The male was quite attentive to the female while she incubated, and although male Purple Martins do not incubate, he frequently guarded the nest when she was away. He also brought green leaves to the nest while the female incubated.

The eggs hatched on 2 July. Both parents fed the young until they were about 3 weeks old. At that time the male gradually stopped feeding. He had ceased feeding completely by the time the young were ready to leave. However, he often appeared and perched by the nest, and he and the female were never hostile toward each other. When the young were about 2 weeks old, the female ceased roosting in the nest and disappeared from the colony each evening at dusk. Each morning she reappeared quite early. The male had stopped roosting at the colony during the incubation period. One young left the nest on 28 July, and the other left on 29 July. No juveniles returned to roost in the nest after 29 July, and the parents rarely appeared.

The unmarked male had no outstanding trait, but from watching his behavior very closely for many hours, I am convinced that the same bird was engaged in both broods. The unmarked female was easy to recognize. She was very white on the lower breast and belly, appearing much lighter than other females that arrived in February. She also had a peculiar habit of running along the entire length of the porch of the martin house before flying. She exhibited this peculiarity during both nestings.

Pair 2: Adult male arrived at colony on 24 February 1976 and began claiming a tier of 4 nest compartments. An adult female arrived on 2 March and established a pair bond with the male. Four young of a first brood fledged from Pair 2's nest on 31 May and 1 June. Soon after the young left, I noticed another adult male claiming this tier of 4 rooms. When Pair 2 attempted to lead their young back to the martin house to roost on 1 June, this new male attacked the juveniles and their male parent, but allowed the female to land on the house and enter her nest. He would not allow the juveniles or male parent to roost in the nest or anywhere else on the tier. The female attempted to lead 1 or 2 of her young back nightly until 8 June, but the new male never allowed the juveniles to roost. He tolerated the female though and frequently courted and sang to her.

On 8 June the female began perching by the nest for long periods, and the new male appeared to establish a pair bond with her. This "revised" Pair 2 spent much time sitting on the martin house on 8–12 June but never brought nesting materials to the house. On 13 June an egg was laid in a room adjacent to the former nest compartment. A small nest was in this new compartment, having been built by this same female earlier in the season when she was building in all rooms on the tier. She laid 1 egg daily until 18 June when she laid her 6th and final egg and began incubation. Her new mate was delinquent in guarding the nest during the incubation period, rarely appeared to guard in the afternoon, and rarely gathered green leaves.

The eggs hatched on 3 July. The female did considerably more feeding of the young than did the male. Daily 2-hour watches of this pair revealed that the female was responsible for 70–88% of the total feeding trips. However, as the young became older the male appeared to develop stronger parental instincts. When the young came out on the porch of the house 2 days prior to leaving, the male guarded them virtually constantly while the female fed them. Three young left on 29 July and 2 left on 30 July. One nestling had disappeared from the nest a week earlier. The female roosted in a room of the tier each night throughout the second nesting, but the male had ceased roosting at the colony during the incubation period. The adults did not lead the juveniles back to the nest to roost after 31 July.

Many times as I watched this new male of Pair 2, he sang to a female that

was feeding young on the tier below him. He often flew down to her and entered her nest. I saw him feed this female's young twice after finding his young unreceptive, and he appeared to be a partial polygynist (See Brown 1975).

The original male of Pair 2 was easy to separate from the new male that took over the nest after the first young left. The original male's purple under tail coverts were extensively edged with white. No other males in the colony had such markings. From watching the unmarked female closely during both broods, I am confident that she was the same individual involved in both. During both broods, she was unusually aggressive toward a pair of House Sparrows (*Passer domesticus*) that nested in a room on a lower tier. She attacked the sparrows whenever she flew from the house. Also, while feeding her second brood, she often first entered her nest of the first brood, then "remembered" her second brood in the adjacent hole and moved to it.

Pair 3: An adult male arrived on 18 March 1976 and established himself in the attic hole of a small wooden martin house. He attracted an adult female on 21 March. Three young of a first brood fledged from Pair 3's nest on 6 June. They brought their young back to the house to roost nightly on 6-14 June. On 15 June I noticed Pair 3 perching by and entering their nest. I often saw them near the nest on 15-19 June, but I never saw them bring nesting materials to the nest during that time. On 16 June I saw several males chasing the female of Pair 3 in a "rape" flight while her mate tried to fight them off. I had never before seen a rape that late in the season. Rape flights by martins are frequent in Sherman, Texas, in March, April, and May while the birds are courting, but are very rare anytime in June.

On 20 June 1 egg was laid in the nest, followed by 1 a day until 24 June when the 5th and final egg was laid and the female began incubation. The male was very attentive to his incubating mate and often guarded the nest when she was away, but he rarely brought green leaves. The eggs hatched on 9 July. Both parents fed the young throughout the nestling period. Neither adult fed at a greater rate than the other. Neither parent roosted at the colony after the young were about 2 weeks old. Three young left the nest on 6 August, and 2 left on 7 August. The parents did not lead them back to the nest to roost after leaving.

This male wore U.S. Fish and Wildlife Service band no. 772-05364. I confirmed this number with a 30× telescope and by capture during both nestings. He had been banded as a nestling at a nearby colony in Sherman in 1974 and nested at my colony in 1975. The female was quite easy to distinguish from all other martins in the colony since the second, third, and fourth primaries of her left wing were missing. The feathers were gone when she

arrived in March, and no noticeable replacement occurred during the breeding season. No other martin in the colony had such a noticeable "gap" in its wing.

Pair 4: An adult female arrived at the colony on 20 February 1976 and began claiming a tier of 4 nesting compartments. An adult male, who was paired to another female on an upper tier, showed interest in the female of Pair 4 and claimed her until 6 March when another adult male arrived and established a pair bond with her. Four young of their first brood fledged on 11 June. After the young fledged, Pair 4 led them back to the nest to roost nightly until 20 June when I noticed the parents perching by the nest for great periods. The juveniles did not return to the nest after 19 June.

Pair 4 spent much time sitting by, and in, the nest on 20–25 June, but never brought nesting materials to the nest during that period. One egg was laid in the nest on 26 June, followed by 1 a day until 29 June when the female laid her 4th and final egg and began incubation. The male was quite attentive to her while she incubated and often guarded the nest when she was away. Virtually every morning until the eggs hatched, this male spent several hours constantly gathering green leaves and bringing them to the nest.

The eggs hatched on 14 July. Both parents fed the young at about equal rates until the young were about 3 weeks old. On 5–6 August the female ceased feeding completely. During the last week before the young left, only the male fed them, and the female only occasionally appeared and sat by the nest. She and the male were never hostile toward each other. All 4 young fledged from the nest on 11 August. The male did not lead them back to the nest to roost after leaving. Both parents ceased roosting at the colony after the young were about 2 weeks old.

The unmarked male had a throat mottled with purple and brown. He was the only all-purple adult male martin I saw that was not uniform purple on the throat. The unmarked female was an old appearing bird, and her breast and belly were largely fuscous instead of dark gray. Her brownish breast contrasted sharply with her purple back. She also had an extremely vertical posture whenever she sat on the martin house. I am convinced that the same individuals were involved in both broods.

Colony Activity 13 June–11 August: From 13 June 1976 when the earliest egg of a second brood was laid until 11 August when the young of the last second brood departed, 21 martin pairs in the colony were engaged in various nesting stages of first broods. The activity of these pairs is summarized in Table 1.

Large numbers of martins visited the colony throughout 13 June–11 August. I often saw 70 or more martins perched on martin houses and wires around the colony while the second broods were in progress. Most of these were birds

TABLE 1

ACTIVITY OF MARTINS RAISING FIRST BROODS AT COLONY WHILE SECOND BROODS WERE IN PROGRESS, 1976

Nesting Stage	June 13	June 27	July 4	July 11	July 18	July 25	August 1	August 8
Feeding Young	11	15	13	8	4	2	1	-
Incubating	7	3	1	-	-	-	-	-
Laying	2	-	-	-	-	-	-	-
Yet to Lay	1	-	-	-	-	-	-	-

Figures indicate number of pairs and do not include 4 second broods.

that had completed breeding, but many were juveniles. Martins were present during most of the day, with largest numbers appearing in the morning. I had never seen such large numbers around the colony in mid- and late July and early August. The many martins around the colony in July reminded me greatly of a thriving colony in June. My studies indicate that many martins becoming post-breeding vagrants and visit colonies in their local area after finishing breeding. They show no definite breeding tendencies but sit on the wires and preen and alight on the martin houses. During Pair 4's last week, very few martins appeared at the colony in the mid-afternoon hours, and Pair 4 reduced the frequency of feeding at that time.

DISCUSSION

I became fully convinced in 1976, through observations of 1 marked and 3 unmarked pairs, that Purple Martins occasionally raise second broods. However, the color banded pairs in 1977 provide unequivocal evidence that Purple Martins are sometimes double-brooded. Since most field work was performed in 1976, the following discussion is based only on the 1976 double-brooded pairs and the breeding season of 1976.

All 4 double-brooded pairs displayed normal breeding behavior while raising second broods. I noted no appreciable behavioral differences among the 4 pairs. They differed from first broods in only 2 aspects, both of which are probably insignificant. None of the pairs built a nest for their second brood, but all already had nests. Three pairs used the original nest hole for their second brood, while 1 used an adjacent compartment. None of the pairs led the young of their second brood back to the nest to roost for a long period after fledging. However, this was probably because the adults themselves were no longer roosting in the nest. I saw many martins of the neighborhood

use a grove of eastern cottonwoods (*Populus deltoides*) for roosting each evening in July and early August.

The male of Pair 1 and the female of Pair 4 ceased feeding the young of their second brood before the young fledged. This loss of parental care may be attributed to the lateness of the season, particularly in Pair 4's case. During the last week when the female of Pair 4 had stopped feeding, I noticed many male martins around the colony but few females (often 25-35 ♂♂:1 ♀), suggesting that females may move to the pre-migratory roosts earlier than males.

Two of the double-brooded males often brought green leaves to the nest during incubation. These double-brooded males gathered more leaves than many single-brooded males, particularly single-brooded subadults.

All double-brooded martins observed were adults. Since adults arrive on the breeding grounds before subadults, it is likely that all second broods in martins are raised by adults. There is no time for later-arriving subadults to rear second broods.

It is probable that all 4 double-brooded pairs successfully fledged their first brood to independency. If the young of a first brood succumbed shortly after leaving the nest, the parents' subsequent second brood might be a re-nest. This is unlikely in my cases though. All 4 pairs led their first brood back to the nest to roost for a week or longer. It is likely that young martins become independent 7-10 days after leaving the nest but I have not determined the true time required for young to become independent.

Regarding Lowery's statement (*in* Allen and Nice 1952) that late nesters may occupy the nest sites after the original martins fledge young and can be confused as second broods, I have found that even after fledging young, many martins maintain close ties with the nest. Most pairs bring their young back to the nest to roost nightly. Returning with the young at night serves to discourage other martins from moving into the nest. Of my double-brooded pairs, only the male of Pair 2 was displaced by an outsider who appropriated the nest after the young fledged. I might also add that at my colony in 1976 there were large numbers of vagrant martins that would have likely moved in had the double-brooded martins not discouraged them by returning each evening with their young. A further deterrent to outsiders moving in is well-pronounced post-breeding nest defense in martins. Post-breeding nest defense has been noted often in my studies and by Finlay (1971).

I began sponsoring Purple Martin propagation efforts in the city of Sherman, Texas, in 1973-76 as an aid to my martin studies. Few martin houses were present in the city in 1968 when I began studying martins and in 1970 when I noted an unsuccessful second brood attempt. By 1976 the number of

martin houses in the city had increased 550%. Populations of Purple Martins increased similarly or more so.

Most martins in Sherman normally finish nesting activities in mid- to late June. Until 1976 I had never recorded martins breeding at my colony after 10–15 July. A second brood in 1970 failed on 14 July. Few martins were present around the colony then (Brown 1973). Numbers of post-breeding vagrant martins that visit the colony also greatly decrease after 10–15 July. Until 1976 I had rarely seen over 30 martins at the colony in late July and August. I made a check of other colonies in Sherman in late July and found few martins around any of them except mine and one small and newly-established colony. An adult pair of martins at this small colony was feeding young in early August. I suspect that this was also a second brood, but I have no proof.

I was impressed by the many martins that raised first broods at my colony in July (and 1 pair in August). More birds in 1976 led to many that were unable to find breeding places until late May and early June. Consequently these birds were still nesting in July. Purple Martin populations apparently exploded in the Sherman area in 1976, resulting in many pairs nesting later than usual. The presence of many martins late in the season undoubtedly provided a stimulus for the rearing of second broods by pairs that fledged young earlier. This is consistent with the second brood attempt in 1970 (Brown 1973).

Johnston and Hardy (1962) believed that very mild and unseasonable weather in southern Illinois provided stimulus for second broods in that area. But in Sherman, Texas, in 1976 weather conditions were normal, and the first arrivals did not begin nesting any earlier than in past years. Presence of other martins late in the season apparently outranks weather conditions as second brood stimulus for martins in north central Texas. Thus, I suggest that second broods by Purple Martins may occur in the southern U.S. whenever large numbers of martins are present at the colonies later than usual. Such numbers may be due to either local population increases or nesting disasters in the early part of the season.

Since most martins leave the Sherman area in mid- to late August, presumably on fall migration, juveniles of second broods have less time before migrating to increase fat reserves and become proficient at catching insects. This could result in greater mortality among juveniles of second broods which would limit any inherited double-broodedness in a local Purple Martin population.

SUMMARY

Four adult pairs of Purple Martins in a colony of 35 pairs in Sherman, Texas, successfully fledged second broods in the breeding season of 1976. Two additional pairs raised

second broods in 1977. Breeding behavior of these second nestings was studied and was found not to differ significantly from breeding behavior of first nestings.

Purple Martin propagation efforts in Sherman, Texas, in 1973-76 resulted in great numbers of martins in the local area in 1976. Many martins were unable to find breeding places in the early part of the season and raised their first broods much later in the season than usual. Such late nesting apparently served as a stimulus to the raising of second broods by pairs that fledged young earlier. Purple Martins may raise second broods in the southern part of their range whenever large numbers of martins remain at the colonies later than usual.

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